UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
1650 Arch Street
Philadelphia, Pennsylvania 19103-2029

Ms. Ellen Gilinsky, Ph.D., Director
Division of Water Quality Programs
Virginia Department of Environmental Quality
629 Main Street
Richmond, VA 23219

Dear Ms. Gilinski:

The Environmental Protection Agency (EPA) Region III is pleased to approve the Total Maximum Daily Load (TMDL) for the aquatic life and primary contact use (bacteria) impairments on Hunting Camp Creek. The TMDL report was submitted to EPA for review in January 2005. The TMDL was established and submitted in accordance with Section 303(d)(1)(c) and (2) of the Clean Water Act to address impairments of water quality as identified in Virginia's 1998 Section 303(d) list.

In accordance with Federal regulations at 40 CFR §130.7, a TMDL must comply with the following requirements: (1) designed to attain and maintain the applicable water quality standards, (2) include a total allowable loading and as appropriate, wasteload allocations (WLAs) for point sources and load allocations for nonpoint sources, (3) consider the impacts of background pollutant contributions, (4) take critical stream conditions into account (the conditions when water quality is most likely to be violated), (5) consider seasonal variations,
(6) include a margin of safety (which accounts for uncertainties in the relationship between pollutant loads and instream water quality), (7) consider reasonable assurance that the TMDL can be met, and (8) be subject to public participation. The enclosure to this letter describes how the TMDL for the aquatic life and primary contact use impairments satisfies each of these requirements.

Following the approval of the TMDLs, Virginia shall incorporate the TMDL into the appropriate Water Quality Management Plans pursuant to 40 CFR § 130.7(d)(2). As you know, all new or revised National Pollutant Discharge Elimination System permits must be consistent with the TMDL WLA pursuant to 40 CFR §122.44 (d)(1)(vii)(B). Please submit all such permits to EPA for review as per EPA's letter dated October 1, 1998.

If you have any questions or comments concerning this letter, please don't hesitate to contact Mr. Thomas Henry at (215) 814-5752.

Sincerely,

Jon M. Capacasa, Director
Water Protection Division

Enclosure

Decision Rationale

**Total Maximum Daily Loads for
the Primary Contact (Bacteriological) and Aquatic Life Use Impairments on
Hunting Camp Creek**

I. Introduction

The Clean Water Act (CWA) requires a Total Maximum Daily Load (TMDL) be developed for those water bodies identified as impaired by a state where technology-based and other controls will not provide for attainment of water quality standards. A TMDL is a determination of the amount of a pollutant from point, nonpoint, and natural background sources, including a margin of safety (MOS), that may be discharged to a water quality-limited water body.

This document will set forth the Environmental Protection Agency's (EPA's) rationale for approving the TMDLs for the primary contact (bacteriological) and aquatic life use impairments on Hunting Camp Creek. EPA's rationale is based on the determination that the TMDL meets the following eight regulatory conditions pursuant to 40 CFR §130.

1) The TMDL is designed to implement applicable water quality standards.
2) The TMDL includes a total allowable load as well as individual waste load allocations (WLAs) and load allocations (LAs).
3) The TMDL considers the impacts of background pollutant contributions.
4) The TMDL considers critical environmental conditions.
5) The TMDL considers seasonal environmental variations.
6) The TMDL includes a margin of safety (MOS).
7) There is reasonable assurance that the TMDL can be met.
8) The TMDL has been subject to public participation.

II. Background

The Hunting Camp Creek Watershed is located in Bland County, Virginia. Hunting Camp Creek is a tributary to Wolf Creek in the New River Basin. The bacteriological and benthic impairments on Hunting Camp Creek extend 8.45 miles from the impoundment above the community of Suiter to its confluence with Wolf Creek. The 20,603-acre watershed is rural with forested and agricultural lands making up 92 and 6 percent of the watershed respectively. Residential and commercial lands make-up the remainder of the watershed.

In response to Section 303(d) of the CWA, the Virginia Department of Environmental Quality

(VADEQ) listed Hunting Camp Creek (VAS-N31R) on Virginia's 1998 Section 303(d) list as being unable to attain the general standard due to an aquatic life use impairment identified through benthic assessments. The primary contact impairment was identified on Virginia's 2002 Section 303(d) list based on violations of the bacteriological criteria. At the time of its listing, the bacteria criteria used fecal coliform as an indicator species and had an instantaneous standard 1,000 colony forming units (cfu) per 100 milliliters (ml) and geometric mean standard of 200 cfu/100ml. This decision rationale will address the TMDLs for both impairments.

Fecal coliform is a bacterium which can be found within the intestinal tract of all warm blooded animals. Fecal coliform indicates the presence of fecal wastes and the potential for the existence of other pathogenic bacteria. The higher concentrations of fecal coliform indicate the elevated likelihood of increased pathogenic organisms.

EPA encouraged the states to use e-coli and enterococci as the indicator species instead of fecal coliform. A better correlation was drawn between the concentrations of e-coli and enterococci, and the incidence of gastrointestinal illness. The Commonwealth adopted e-coli and enterococci criteria in January 2003. According to the new criteria, streams are evaluated via the e-coli and enterococci criteria after 12 samples have been collected using these indicator species. Twelve e-coli samples have been collected from Hunting Camp Creek and it is therefore, assessed, according to the new criteria.

As Virginia designates all of its waters for primary contact, all waters are required to meet the bacteriological standard for primary contact. Virginia's standard applies to all streams designated as primary contact for all flows. The e-coli criteria requires a geometric mean concentration of 126 cfu/100ml of water with no sample exceeding 235 cfu/100 ml of water. The new e-coli criteria requires the concentration of e-coli not to exceed 235 cfu/100ml of water.

Although the TMDL and criteria require the 235 cfu/100 ml of water concentration limit not be exceeded, waters are not placed on the Section 303(d) list if their violation rate does not exceed 10 percent. Therefore, Hunting Camp Creek may be deemed as attaining its primary contact use prior to the implementation of all of the TMDL reductions. It is necessary to keep this in mind because the reductions required to attain the instantaneous criteria for e-coli in the model are extremely stringent.

To assess the biological integrity of a stream, Virginia uses EPA's Rapid Bioassessment Protocol II (RBPII) to determine status of a stream's benthic macroinvertebrate community.[1] This approach evaluates the benthic macroinvertebrate community between a monitoring site and its reference station. Measurements of the benthic community, called metrics, are used to identify

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[1]Tetra Tech 2002. Total Maximum Daily Load (TMDL) Development for Blacks Run and Cooks Creek. Fairfax, Virginia.

differences between monitored and reference stations.[2] The state is currently in the process of changing this methodology to a stream condition index (SCI) approach.

As part of the RBPII approach, reference stations are established on streams which are minimally impacted by humans and have a healthy benthic community. These reference stations represent the desired community for the monitored sites. Monitored sites are evaluated as non-impaired, slightly impaired, moderately impaired, or severely impaired based on a comparison of the biological community of the reference and monitored sites. Streams that are classified as moderately (after a confirmatory assessment) or severely impaired after an RBPII evaluation are classified as impaired and are placed on the Section 303(d) list of impaired waters. Hunting Camp Creek was assessed as moderately impaired. Based on the SCI method, the stream is just below the proposed impairment threshold of 61, the average SCI score Hunting Camp Creek is 57 with a range of scores from 46-73.

The RBPII analysis assesses the health of the macroinvertebrate community of a stream. The analysis will inform the biologist if the stream's benthic community is impaired. However, it will not inform the biologist as to what is necessarily causing the degradation of the benthic community. Additional analysis may be required to determine the pollutants which are causing the impairment as information can be gleaned based on the composition of the community and the condition of the habitat. TMDL development requires the identification of impairment causes and the establishment of numeric endpoints that will allow for the attainment of designated uses and water quality criteria.[3]

A reference watershed approach was used to determine the numeric endpoints for the pollutants impacting Hunting Camp Creek. Numeric endpoints represent the water quality goals that are to be achieved through the implementation of the aquatic life use TMDL which will allow the impaired water to attain its designated use. A reference watershed approach is based on selecting a non-impaired watershed that shares similar landuse, ecoregion, and geomorphological characteristics with the impaired watershed. The stream conditions and loadings in the reference stream are assumed to be the conditions needed for the impaired stream to attain standards.

The bacteriological TMDL submitted by Virginia is designed to determine the acceptable load of e-coli which can be delivered to the impaired segment, as demonstrated by the Loading Simulation Program C++ (LPSC++), in order to ensure that the water quality standard is attained and maintained. LPSC is a watershed modeling system that includes streamlined algorithms from the Hydrologic Simulation Program Fortran (HSPF). LPSC++ is considered an appropriate model to analyze the impaired water because of its dynamic ability to simulate both watershed loading and receiving water quality over a wide range of conditions. The model was run to determine the fecal coliform loading to

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[2]Ibid 1

[3]Ibid 1

Hunting Camp Creek. A translator equation was used to convert fecal coliform results to e-coli.

The bacteriological TMDL analysis allocates the application/deposition of fecal coliform to land based and instream sources. For land based sources, the model accounts for the buildup and washoff of pollutants from these areas. Buildup (accumulation) refers to all of the complex spectrum of dry-weather processes that deposit or remove (die-off) pollutants between storms.[4] Washoff is the removal of fecal coliform which occurs as a result of runoff associated with storm events. These two processes allow the model to determine the amount of fecal coliform from land based sources which is reaching the stream. Point sources and wastes deposited directly to the stream were treated as direct deposits. Wastes which are deposited directly to the stream do not need a transport mechanism.

Local rainfall and temperature data were needed to develop the model. Weather data provides the rainfall data which drives the TMDL model. Weather data was obtained from the Wise 3E and Staffordsville 3 ENE weather stations.

Continuous stream flow data was not available for Hunting Camp Creek. Therefore, a paired watershed approach was used to develop the hydrology model for the bacteria TMDL. The model was developed to a United States Geological Survey (USGS) gage on Wolf Creek, which Hunting Camp Creek is a tributary to Wolf Creek. The Wolf Creek Watershed, including Hunting Camp Creek, was divided into nine segments for the model. The bacteria loading model was calibrated and validated against observed data from the VADEQ monitoring stations within the Hunting Camp Creek Watershed.

The benthic TMDL was developed using the Generalized Watershed Loading Function model (GWLF). The GWLF model provides the ability to simulate runoff, sediment, and nutrient loadings from watersheds given variable source areas (e.g., agricultural, forested, and developed land).[5] GWLF is a continuous simulation model that uses daily time steps for weather data and water balance calculations.[6] Calculations are made for sediment based on daily water balance totals that are summed to give monthly values. A mass balance model to predict the concentrations of metals in stream sediments was used in combination with the GWLF to determine the loading of metals to the stream. The concentrations of copper and zinc in the sediments were modeled and calibrated to the median concentrations observed at ambient monitoring stations.

A reference watershed approach was used to estimate the necessary load reduction needed to

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[4]CH2MHILL, 2000. Fecal Coliform TMDL Development for Cedar, Hall, Byers, and Hutton Creeks Virginia,

[5]Ibid 1

[6]Ibid 1

restore a healthy aquatic community and allow the Hunting Camp Creek to achieve its designated uses. The Laurel Creek Watershed was selected as the reference watershed for Hunting Camp Creek. Laurel Creek is the largest tributary to Hunting Camp Creek. The target sediment load for the impaired segment was the median modeled sediment loads for Laurel Creek.

Table 1 - Summarizes the Specific Elements of the TMDL.

Segment	Parameter	TMDL	WLA	LA	MOS
Hunting Camp Creek	E-coli (cfu/yr)	7.18E+12	0.00	7.18E+12	Implicit
Hunting Camp Creek	Sediment (lbs/yr)	1,580,324	0.00	1,422,193	158,132

The United States Fish and Wildlife Service has been provided with copy of the TMDL.

III. Discussion of Regulatory Conditions

EPA finds that Virginia has provided sufficient information to meet all of the eight basic requirements for establishing a primary contact (bacteriological) and aquatic life (benthic) use impairment TMDL for Hunting Camp Creek. EPA is therefore approving the TMDL. EPA's approval is outlined according to the regulatory requirements listed below.

1) The TMDL is designed to meet the applicable water quality standards.

Bacteria

Virginia has indicated that excessive levels of fecal coliform due to nonpoint sources (both wet weather and directly deposited nonpoint sources) have caused violations of the water quality criteria and designated uses on Hunting Camp Creek. The water quality criterion for fecal coliform was a geometric mean 200 cfu/100ml or an instantaneous standard of no more than 1,000 cfu/100ml. Two or more samples over a thirty-day period are required for the geometric mean standard. Since the state rarely collects more than one sample over a thirty-day period, most of the samples were measured against the instantaneous standard.

The Commonwealth has changed its bacteriological criteria as indicated above. The new e-coli criteria requires a geometric mean of 126 cfu/100ml of water with no sample exceeding 235 cfu/100 ml. The new criteria is more stringent and if the loading remains constant the violation rate should increase.

The LPSC++ model was used to determine the fecal coliform deposition rates to the land as

well as loadings to the stream from direct deposit sources. Once the existing load was determined, allocations were assigned to each source category to develop a loading pattern that would allow Hunting Camp Creek to support the e-coli water quality criterion and primary contact use. The following discussion is intended to describe how controls on the loading of e-coli to Hunting Camp Creek will ensure that the criterion is attained.

The TMDL modelers determined the fecal coliform production rates within the watershed. Data used in the model was obtained from a wide array of sources, including farm practices in the area, the amount and concentration of farm animals, animal access to the stream, wildlife in the watershed, wildlife fecal production rates, landuses, weather, stream geometry, etc.. The model combined all of the data to determine the hydrology and water quality of the stream. The lands within the watersheds were categorized into specific landuses. The landuses had specific loading rates and characteristics that were defined by the modelers. Therefore, the loading rates are different in lands defined as forested versus pasture. Pasture lands support cattle and are influenced differently by stormwater runoff.

The Hunting Camp Creek bacteria TMDL model was run using weather data collected from the Wise 3E and Staffordsville 3 ENE weather stations. This data was used to determine the precipitation rates in the watershed which transport land deposited pollutants to the stream through overland and groundwater flow. Waste that was deposited to the land or stored was subjected to a die-off rate. The longer fecal coliform stayed on the ground the greater the die-off. Materials that were washed off the surface shortly after deposition were subjected to less die-off. The hydrology model of the TMDL was calibrated to a paired watershed (Wolf Creek). Hunting Camp Creek is a tributary to Wolf Creek. The water quality model for bacteria was calibrated to observed data collected from Hunting Camp Creek.

Through the development of this and other similar TMDLs, it was discovered that natural conditions (wildlife contributions to the streams) could cause or contribute to violations of the bacteria criteria. Many of Virginia's TMDLs, including the TMDL for Hunting Camp Creek, have called for some reduction in the amount of wildlife contributions. EPA believes that a significant reduction in wildlife is not practical and will not be necessary due to the implementation plan discussed below.

A phased implementation plan will be developed for all streams in which the TMDL calls for reductions in wildlife. In Phase 1 of the implementation, the Commonwealth will begin implementing the reductions (other than wildlife) called for in the TMDL. In Phase 2, which can occur concurrently to Phase 1, the Commonwealth will consider addressing its standards to accommodate this natural loading condition. The Commonwealth has indicated that during Phase 2, it may develop a Use Attainability Analysis (UAA) for streams with wildlife reductions which are not used for frequent bathing. Depending upon the result of the UAA, it is possible that these streams could be designated for secondary contact.

After the completion of Phase 1 of the implementation plan, the Commonwealth will monitor the

stream to determine if the wildlife reductions are actually necessary, as the violation level associated with the wildlife loading may be smaller than the percent error of the model. In Phase 3, the Commonwealth will investigate the sampling data to determine if further load

reductions are needed in order for these waters to attain standards. If the load reductions and/or the new application of standards allow the stream to attain standards, then no additional work is warranted. However, if standards are still not being attained after the implementation of Phases 1 and 2, further work and reductions will be warranted.

Benthic

As stated above, the biological assessments on Hunting Camp Creek were not able to discern a clear stressor to the Creek. The TMDL modelers therefore conducted a stressor identification analysis to determine what was impacting the benthic community. Ambient water quality data was able to rule out dissolved oxygen (DO), temperature or pH as possible stressors to Hunting Camp Creek. An excessive loading of sediment was seen as the cause of the benthic impairment on Hunting Camp Creek. In high enough concentrations sediment can have detrimental impacts on the benthic community. Sediment fills interstitial spaces that provide habitat for many organisms. Excessive levels of sediment may also clog an organisms gill surfaces thus lowering its respiratory ability. Lastly, excessive sediment increases turbidity which lowers the feeding efficiency of visual predators.

The GWLF model was used to determine the loading rates of sediment to the impaired and reference stream from all point and nonpoint sources. The TMDL modelers determined the sediment loading rates within each watershed. Data used in the model was obtained on a wide array of items, including land uses in the area, point sources in the watershed, weather, stream geometry, etc..

The GWLF model provides the ability to simulate runoff and sediment loadings from watersheds given variable source areas (e.g., agricultural, forested, and developed land). GWLF is a continuous simulation model that uses daily time steps for weather data and water balance calculations.[7] Local rainfall and temperature data were needed to simulate the hydrology, this data was obtained from the Staffordsville and Bristol Airport weather stations. In the GWLF model, the nonpoint source load calculation is affected by terrain conditions, such as the amount of vegetative, land slope, soil erodibility, and land practices used in the area.[8] Parameters within the model account for these conditions and practices. Since there were no flow gages with appropriate data for calibrating the GWLF model within the impaired and reference watersheds, the hydrology component of the model was calibrated to the USGS gage on Wolf Creek.

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[7]Ibid 1

[8]Ibid 1

2) The TMDL includes a total allowable load as well as individual waste load allocations and load allocations.

Total Allowable Loads

Virginia indicates that the total allowable loading is the sum of the loads allocated to land based precipitation driven nonpoint source areas (forest and agricultural land segments) and point sources. Activities that increase the levels of bacteria and sediment to the land surface or their availability to runoff are considered flux sources. The actual value for total loading can be found in Table 1 of this document. The total allowable load is calculated on an annual basis.

Waste Load Allocations

There were no facilities identified as discharging either sediment or bacteria to Hunting Camp Creek. Most of the homes in the watershed are connected to a local sewage treatment plant which does not discharge to Hunting Camp Creek.

EPA regulations require that an approvable TMDL include individual WLAs for each point source. According to 40 CFR 122.44(d)(1)(vii)(B), "Effluent limits developed to protect a narrative water quality criterion, a numeric water quality criterion, or both, are consistent with assumptions and requirements of any available WLA for the discharge prepared by the state and approved by EPA pursuant to 40 CFR 130.7." Furthermore, EPA has authority to object to the issuance of any National Pollutant Discharge Elimination System (NPDES) permit that is inconsistent with the WLAs established for that point source.

Load Allocations

According to Federal regulations at 40 CFR 130.2(g), LAs are best estimates of the loading, which may range from reasonably accurate estimates to gross allotments, depending on the availability of data and appropriate techniques for predicting loading. Wherever possible, natural and nonpoint source loads should be distinguished.

In order to accurately simulate landscape processes and nonpoint source loadings of bacteria, VADEQ used the LPSC++ model to represent the impaired watersheds. The LPSC++ model is a comprehensive modeling system for the simulation of watershed hydrology, point and nonpoint source loadings, and receiving water quality. LPSC++ uses precipitation data for continuous and storm event simulation to determine total loading to the impaired segments from the various land uses within the

watershed.

For the sediment TMDL the GWLF model was used to ascertain the sediment loading to Hunting Camp Creek and Laurel Creek the reference watershed. The model provides the monthly sediment load to the stream through the use of the universal soil loss equation (USLE). The USLE derives the sediment loading by using information on precipitation rates, best management practices, land slope, and vegetative cover. Tables 3a and 3b identify the current and TMDL loading for bacteria and sediment to Hunting Camp Creek.

Table 3a - LA for Bacteria (E-coli) for Hunting Camp Creek

Source Category	Existing Load (cfu/yr)	Allocated Load (cfu/yr)	Percent Reduction
Cropland	1.06E+12	1.06E+10	99
Built Up	7.93E+12	7.93E+10	99
Pasture	2.55E+13	2.55E+11	99
Forest	4.67E+12	4.67E+12	0
Livestock - Direct	3.35E+13	3.35E+11	99
Wildlife - Direct	2.35E+12	1.83E+12	22
Straight Pipes and Sewer Overflows	<1.00E+04	0.00E+00	100

Table 3b - LA for Sediment for Hunting Camp Creek

Source Category	Existing Load (lbs/yr)	Proposed Load (lbs/yr)	Percent Reduction
Transitional	160,320	89,779	44
Pasture/Hay	768,007	445,444	42
Row Crops	339,402	196,853	42
Urban	1,025	1,025	0
Forest	163,685	163,685	0
Streambank	905,874	525,407	42

3) The TMDL considers the impacts of background pollution.

The TMDL considers the impact of background pollutants by considering the bacteria and sediment loadings from background sources like wildlife and forested lands.

4) The TMDL considers critical environmental conditions.

According to EPA's regulation 40 CFR 130.7 (c)(1), TMDLs are required to take into account critical conditions for stream flow, loading, and water quality parameters. The intent of this requirement is to ensure that the water quality of Hunting Camp Creek is protected during times when it is most vulnerable.

Critical conditions are important because they describe the factors that combine to cause a violation of water quality standards and will help in identifying the actions that may have to be undertaken to meet water quality standards[9]. Critical conditions are a combination of environmental factors (e.g., flow, temperature, etc.), which have an acceptably low frequency of occurrence. In specifying critical conditions in the waterbody, an attempt is made to use a reasonable "worst-case" scenario condition. For example, stream analysis often uses a low-flow (7Q10) design condition because the ability of the waterbody to assimilate pollutants without exhibiting adverse impacts is at a minimum.

The HSPF and GWLF models were run over a multi-year period to insure that they accounted for a wide range of climatic conditions. The allocations developed in these TMDLs will therefore insure that the criteria are attained over a wide range of environmental conditions including wet and dry weather conditions.

5) The TMDL considers seasonal environmental variations.

Seasonal variations involve changes in stream flow and loadings as a result of hydrologic and climatological patterns. In the continental United States, seasonally high flows normally occur in early spring from snow melt and spring rain, while seasonally low flows typically occur during the warmer summer and early fall drought periods.

Bacteria loadings also change during the year based on crop cycles, waste application rates, vegetative cover and cattle access patterns. Consistent with the discussion regarding critical conditions, the HSPF and GWLF models and TMDL analysis effectively considered seasonal environmental variations through the use of observed weather data over an extended period of time and by modifying waste application rates, crop cycles, and livestock practices.

6) The TMDL includes a margin of safety.

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[9]EPA memorandum regarding EPA Actions to Support High Quality TMDLs from Robert H. Wayland III, Director, Office of Wetlands, Oceans, and Watersheds to the Regional Management Division Directors, August 9, 1999.

This requirement is intended to add a level of safety to the modeling process to account for any uncertainty. The MOS may be implicit, built into the modeling process by using conservative modeling assumptions, or explicit, taken as a percentage of the WLA, LA, or TMDL. Virginia included an implicit MOS in the bacteria TMDL through the use of conservative modeling assumptions. An explicit 10 percent MOS was used for the sediment TMDL.

7) There is a reasonable assurance that the TMDL can be met.

EPA requires that there be a reasonable assurance that the TMDLs can be implemented. WLAs will be implemented through the NPDES permit process. According to 40 CFR 122.44(d)(1)(vii)(B), the effluent limitations for an NPDES permit must be consistent with the assumptions and requirements of any available WLA for the discharge prepared by the state and approved by EPA. Furthermore, EPA has authority to object to issuance of an NPDES permit that is inconsistent with WLAs established for that point source.

Nonpoint source controls to achieve LAs can be implemented through a number of existing programs such as Section 319 of the CWA, commonly referred to as the Nonpoint Source Program.

8) The TMDLs have been subject to public participation.

During the development of the TMDL for the Hunting Camp Creek Watershed, public involvement was encouraged through several meetings to discuss and disseminate the Hunting Camp Creek TMDL. A basic description of the TMDLs process and the agencies involved was presented at a kickoff meeting on June 25, 2003 at the Bland County School Board Offices in Bastian, Virginia with eight people in attendance. The first public meeting was held on September 22, 2003 at the Bland County School Board Offices in Bastian, Virginia with 26 people in attendance. The second and final public meeting was held on November 8, 2004 at the Bland County School Board Offices in Bastian, Virginia. Forty-two people attended the final public meeting. Both public meetings were noticed in the Virginia Register and open to a thirty-day public comment period. No written comments were received.